

TECHNOLOGY TOOLS

By Erick Haas & John Hanchar

Auto Guidance Systems on Farms: Benefits and Costs for Decision Making

Farmers who are thinking about investing in precision agriculture technology might consider this example of a farmer who was working with an advisor on an analysis to help with decision making. They assumed two passes, as accurate as possible, were made down the field to spread fertilizer. On a 48' swath, the farmer was overlapping at least 6'. For analysis, they took the 6' of overlap across the farm's acres and calculated the waste in fuel, time, and product, and then multiplied by how many times the farmer would spread the acres throughout the growing year. They estimated that in less than one season the farmer would have realized a positive return on the investment.

The business of farming continues to demand maximum efficiencies by farmers. Input costs continue to rise, and revenue continues to fluctuate, often below cost. Agriculture equipment manufacturers continue to move forward, pushing the cutting edge by integrating technology into today's machines. These technologies include section control, variable rate application, machine telematics, crop nutritional values at harvest, and most popular of all, Automatic Guidance (auto steer). Technologies can save money on time and inputs, and may enhance yields.

Auto steer offers a number of benefits to a farm operation. Economic savings can easily be measured. What cannot be measured is the positive effect it can have on the operator. Several users have said that when they hop out of the tractor after a full day of planting they're not completely exhausted. This gives them time to tackle another task, or enjoy time at home with their family.

The accuracy of a machine to manually follow a path relies solely on the operator. Performing field work, such as tillage, planting, spraying and other operations, safely and accurately using manual steering is difficult, and can lead to overlap, operator stress and fatigue. As most farmers know, monitoring the task at hand, the machine, and direction of travel, simultaneously while answering the cell phone can prove to make a 12+ hour day rather exhausting. Other compounding factors can include operating in low light conditions while trying to beat the rain coming in. Investing in auto steer technology can eliminate a large piece of that matrix.

Auto steer requires three main ingredients: a machine capable of

Farm business owners should evaluate satellite guided auto steer systems for potential improved results.

auto steer, a display interface with an activation, and a satellite receiver. Accuracy levels of auto steer can range from as low as $\pm 12"$, to sub-inch accuracy. The more accurate a system, the more it costs. Take advantage of analysis provided by equipment professionals, advisors and other agriservice professionals to make decisions. Some analyses will calculate how long it will take for a positive Return on Investment (ROI), while others apply time value of money approaches from capital investment analysis.

Partial budgeting results suggest that adoption of auto steer can be a profitable change in a farm business compared to manual steering (Table 1). (For more results see Hanchar and Haas. nydairyadmin.cce.cornell.edu/pdf/newsletter/pdf104_pdf.pdf). Selected assumptions not provided in Table 1 include: 1) one auto steer unit with an expected useful life of ten years is suitable given the expected acres affected; 2) 2015 price levels; 3) tasks affected include spring chisel plowing, spring field cultivating, corn planting, and fall chisel plowing for residue management.

Results are sensitive to variability in expected acres of corn affected and initial overlap without auto guidance.

Auto steer does not require a brand new, fully integrated machine. Auto steer can be installed on any color machine of any age, since these systems can be installed stand-alone. It allows them to be transferred to another in a matter of minutes, thereby maximizing the efficiency of the investment. An example is: using auto steer on tractor 1 for tillage, then moving it to tractor 2 for planting, then to tractor 3 for spraying, and maybe tractor 4 for mowing.

Once auto steer is successfully adopted, the next area of attention could be another entry level precision farming technology. Auto section control reduces double planting and other crop input usage in headlands. Seed, chemical and other input usage declines. Again, a farmer benefits in numerous ways, and should evaluate expected financial and economic outcomes to make decisions.

A next phase beyond entry level technologies is often variable rate input use. Some farmers focus initially on lime, potash, and seeds. The GPS system that is the foundation of entry level technologies plays a prominent role in data collection and management tasks. Prescriptions, or recommended input levels that vary by field

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impact the sensors differently. Recalibration should occur as often as practical, but especially when crop or harvest conditions change significantly (% moisture, test weight, etc.). Always run the calibration procedures in a representative area of the field. Avoid headlands or areas of inconsistent poor crop as this will affect calibration accuracy. For combines, vary harvest speed and crop flow; whereas for forage harvesters, uniform crop harvested at expected operating speed is recommended. Both will provide best results when larger calibration loads are measured. Be sure to have a plan for how to measure loads. Accuracy is essential, so a good practice is to use certified scales or calibrated weigh wagons. Using the same measuring equipment throughout the process will ensure best results.

An important consideration for forage harvesters before beginning the yield calibration process is feed roll adjustment. Since this is where crop mass entering the unit is measured, it is important to ensure that the “zero point” is within the manufacturers specifications. It is not uncommon for this set point to move out of adjustment or become displaced as heads are changed or residual crop material accumulates. Sensors that signal the Display to start and stop data recording will likewise benefit from in spec feed roll

positioning. As previously mentioned, NIR and Capacitance moisture sensors on these machines do not require in-field calibration. Unexpected variability in moisture readings are often the result of soiled or misaligned sensors. The operator’s manual is the best asset to ensure proper sensor alignment.

After the harvester is properly calibrated, do not assume that the recorded data is error-free. GPS signal disruption and improper header height operation will leave data gaps. Harvesting a partial width of the cutter head and/or starting and stopping frequently will result in skewed yield values. While many of the errors can be removed via Post Processing or “Cleaning,” this task can be time consuming and frustrating. It is better to be aware of what causes errors so you can act to minimize them.

A properly maintained and calibrated yield monitoring system is an asset to any crop farming operation. Accurate yield and moisture maps can help drive informed decision-making. Identification of spatial variability within fields opens the door to prescriptive management opportunities. While there’s always something else to do, calibrating yield equipment will undoubtedly provide value whether you intend to leverage the “Power of the Data” now or in the future. □

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location, are an important feature. Data collection, analysis and management using the GPS based system produces yield maps that support the identification of management zones – those areas of a field that will likely benefit from receiving different rates of an input, for example, lime. Decision making benefits from financial and economic analysis, particularly given the sizeable capital investment requirements associated with variable rate technologies.

Contact a dealer for a demonstration, and to gain a better understanding of the impact of auto steer technology on your bottom line.

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Table 1. Expected Change in Profit by Expected Acres of Corn by Overlap without Auto Steer.

Expected Acres of Corn Affected	Overlap Without Auto Steer (%)		
	5	10	13
--- Annual change in profit (dollars) ---			
250	-145	1,459	2,421
500	1,459	4,666	6,590
Notes: 1) Expected change in value of production = \$0; 2) expected initial capital cost = \$12,000; 3) expected overlap with auto steer = 0%			

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